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REALIGNMENTS IN GREATER MEDICINE: THEIR EFFECT UPON SURGERY AND THE INFLUENCE OF SURGERY UPON THEM · GENERAL ADDRESS IN SURGERY DELIVERED TO THE XVIIth INTERNATIONAL CONGRESS OF MEDICINE, AT ITS MEETING IN LONDON ON AUGUST 7, 1913

BY

HARVEY CUSHING, M.D., (Hon.) F.R.C.S. Eng.

PROFESSOR OF SURGERY, HARVARD UNIVERSITY

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PREFACE

In the following essay, which formed the surgical address before the 17th International Congress of Medicine at its meeting in London in August of 1913, I have attempted to indicate some of the transformations which have taken place or appear to be taking place in the profession of medicine, and more particularly those which concern the province of the surgeon.

I may have said more than was necessary in regard to experimentation upon animals and the handicap which has been put upon British medicine by ill-advised legislation, but the subject is not one for silence if speech can in any measure lend encouragement and support to the work of the Research Defence League, of which the son of the president of that notable International Congress of 1881 is the honorary secretary. Stephen Paget's two volumes, the more recent of which contains the essentials of the testimony before the last Commission, should be familiar to every physician and student of medicine. Rousseau's passage, *The truth is in the facts and not in the mind that observes them,* might well be the prefix of these publications.

A review of surgical progress is often made the subject-matter of the occasional address under similar circumstances. This custom was observed by Volkmann at the former London Congress, and had I possessed the virile pen of 'Richard Leander', his example might well have been followed, for much has happened in surgery since 1881, when not even had appendicitis been baptized. I endeavoured, however, to confine myself to the more general character of the changes in surgery so far as they are apparent, rather than to give specific illustrations of what the operator dares do to-day and dared not do yesterday. Had I adopted the latter plan, there are many names I should have wished to mention, of men in many countries who have made notable contributions to the craft of surgery.

Choosing the former and more general plan, I recall, in all humility, what Helmholtz wrote in the brief notes for his last and undelivered *Naturforscher-Rede*, to the effect that for any speaker who has undertaken to address a general meeting of an association, the changes which have taken place in the general aspects of science constitute his fittest theme. 'In sciences', he said, 'which have already attained a high degree of elaboration, these alterations can only take place slowly, and in little isolated steps. It is after comparatively long periods that they first become plainly perceptible, and then only to those who can look back over the experiences of a long life, passed in the midst of scientific work and the frequent reflections and doubts attaching to it, or to those who have acquired a corresponding knowledge of the historical development of science by special historical studies.'

BOSTON, *September* 1913.

REALIGNMENTS IN GREATER MEDICINE

THEIR EFFECT UPON SURGERY AND THE INFLUENCE OF SURGERY UPON THEM

Mr. President, Ladies, and Gentlemen,—Thirty-two years have elapsed—a full generation—since this Congress, under the distinguished leadership of Sir James Paget, last gathered in London. Among the participants on that occasion were five of the immortals in the history of the medical sciences: Huxley—naval surgeon, zoologist, palæontologist, educator, philosopher, public servant; Virchow—pathologist, anthropologist, archæologist, statesman, and sanitarian; Pasteur, the chemist, Lister, the surgeon, and Koch, the bacteriologist—among the foremost contributors of all time to the welfare of their kind. On the foundation which these men laid—a new conception of biology and man's place in nature; the doctrine of cellular pathology; fermentation and immunity; wound-healing without suppuration; bacterial diseases—a transformed medical edifice has been erected. Methods of investigation, the direct outcome of those which they evolved, we still employ; weapons which they devised are still, and always will be, effective, not only in a hand-to-hand conflict with individual examples of many of the disorders to which man and the animals needful to his existence are exposed, but better still in their prevention.

The London Congress of 1881 and its participants.

A few years before that meeting the profession of medicine, and particularly those concerned with its basic science, physiology, had been called upon in this city to defend themselves against the public charge of cruelty in their pursuit of knowledge. There had been no striking practical demonstration of the value to the common weal of animal experimentation such as an unenlightened public demanded—such, indeed, as an unenlightened profession expected. The defence was based chiefly on the need, even at the cost of animal life, of increased knowledge concerning the functions of the human body; but despite the warnings and protests of Huxley and a few others the restrictive legislation of which you know was passed. Since then in the British Isles, and consequently in other English-speaking countries, medicine has been placed in the absurd

The restrictive legislation of 1876.

position of defending the character of the labours necessary for its advancement.

But all this is changing, and, indeed, began to change soon after that memorable Congress of 1881. Virchow, though his great contributions had come through mortisection studies rather than through observations on the living, gave an elaborate historical review of the value of experimentation to general pathology. Pasteur at one of the sessions presented the results of his work on vaccination against chicken cholera and anthrax ; at another Koch gave demonstrations of his newer bacteriological technique. In the surgical section the question of chief moment concerned primary wound-healing, and, in the emphatic discussions which followed, Lister, who had perforce been required to conduct some of his investigations in France, described his experiments demonstrating the bactericidal properties of blood serum. Between the lines of the printed reports one can easily perceive the coming transformation of antiseptic into aseptic surgery.

Its consequences.

The seed of knowledge often finds a better soil when blown or carried to a distance, and in this instance it was across the Channel, where no discouraging blight was put upon the sort of research that is as necessary for the furtherance of surgery as for that of any other subdivision of greater Medicine. For it was on the Continent that the principles established by Lister took firm root and, particularly in Germany, were so ardently cultivated through experimentation and practice that modern surgery bears a more vigorous Teutonic than Gallic or Anglican graft. And is it not due solely to this legislative restraint upon the freedom of investigation that in these thirty years this country, which has continued to produce the greatest of names in the experimental sciences free from statutory restriction, has given us few instead of many notable successors to Hunter and Cheselden, to Cooper and Pott and Brodie, to Bell and Paget and Lister, who contributed to the science no less than to the craft of surgery? It would seem, indeed, that the restrictions placed upon animal experimentation have deterred the physician and surgeon from productive laboratory investigation far more than the physiologist, whose inclinations towards research the statutes of 1876 were expressly designed to hold in check ; for Great Britain's representatives of pure physiology and experimental neurology, despite the hampered conditions under which they work, stand out as the chief contributors of the generation to British medicine, though the public cannot appreciate, nor the profession for the moment fully understand, the significance of their labours.

The spirit of investigation—all too rare—should be generously subsidized rather than taxed, encouraged rather than hindered. The outresult of the experiments of one participant in that Congress of 1881 is said to have saved enough for France to enable her to pay the heavy indemnity which the outcome of a war had imposed upon her. Nature is loth to give up her secrets ; discoveries do not come by chance ; they are made by those only who are industriously prepared to observe them,

and the inquisitorial methods of those who seek the light through experimentation, misjudged as cruel, are necessarily stern and persistent, whether the investigator deals with inanimate objects or with animate beings. Possibly Pasteur's greatest scientific triumph lay in a discovery in crystallography, but the same method of work was pursued in his studies of fermentation which inaugurated a new era in the brewing and wine-making industries ; in the saving of the silkworm from a destructive parasite, of poultry from cholera, of flocks from anthrax, and in the elaboration of an effective barrier against the most frightful of deaths—that from hydrophobia. From crystals under the microscope, to yeasts, to the silkworm, to chickens and sheep, to man—and when his studies reached man, who was henceforth to be saved from the poisonous bite of his friend and ally, the dog, Pasteur was accused of cruelty to animals. And the name of this simple and loving man, acknowledged the greatest of Frenchmen, but whom France alone cannot claim, is met with hisses when mentioned on certain platforms before gatherings of presumably intelligent people !

The London Congress of 1913 and the legislative inquiry of 1906.

This Congress meets again in London, under circumstances strangely similar to those of a generation ago. Again a legislative inquiry has just been forced upon British medicine by those who would abolish experimentation upon animals. But how different the testimony ! It bared to the public gaze a science of medicine which in thirty years had become transformed throughout the world as a result of the very activities the Commissioners were called to investigate. Medicine no longer, even as a practising profession, is looked upon as uncommunicative, consulting in the back room as though it had something to conceal from patient or family, for in the individual case the family, and in the general case the public, are not only awakened, but are sufficiently interested and informed to come into an open consultation and to share in the struggle against disease. Great funds are devoted to the purpose ; great corporations are held responsible for the health of their people ; formerly uninhabitable zones of the globe are being rid of their plagues ; governments, civic, state and national, not only employ the weapons of attack and defence forged in laboratories whose methods were in question a generation ago, but expect their medical officers to make progressive contributions by further researches.

A transformed medicine.

All these great movements, of which Huxley and Virchow and Pasteur must have had some foresight, are but expressions of the new alignments taking place in the profession of medicine—alignments which affect the surgeon no less than the physician.

Effect on the practice of medicine.

It has been a seeming paradox that the medical profession has so consistently endeavoured to make of the world a place where there is a constantly lessening need for the medical man. He is, indeed, already feeling the effect of these efforts, and as he becomes more and more a servant of the public health, and less and less a prescriber for individual ills, he philosophically

accepts and humanely welcomes this outcome of medical discoveries which the experimental method has already given and will increasingly continue to give.

Disorders which gave bread and butter to his predecessors are disappearing, as small-pox disappeared after Jenner. One injection robs diphtheria of its terrors, another, meningitis. Typhoid fever, which once replenished the doctor's autumnal pocket-book, is now looked upon as a civic disgrace, and where it exists or is likely to break out, protective vaccination is performed against it. Tuberculosis is everywhere fast coming under State care, and the widespread campaign against the disease, in which those outside the profession are taking no insignificant part, is gradually lessening its ravages. The health of children attending the public schools is supervised by appointed officers; district nurses and the social service worker visit the homes of the sick and assume duties which the hospital physician long neglected; a privately endowed Commission takes steps to eradicate hook-worm infection from a whole zone of the globe; an organized Red Cross Society, with Government affiliation, steps in in great emergencies; Governments see fit to pass Insurance Acts which make public officials of the profession at one sweep. Dr. Pound of Cure Lane is being superseded by his young disciple, Dr. Ounce of Prevention Street.

In matters of health the people as a whole have been largely permitted to shift for themselves, and when they have forgotten how large a percentage of the faces of the eighteenth century and before were pock-marked, many of them wish again to exercise their individual discretion regarding vaccination. 'Where there is no vision the people perish.' Governments, though interested in the welfare of the domesticated animals, are too often indifferent to the public health, and only in the face of emergencies, the greatest of which continues to be warfare, are they stirred to action, since freedom from disease is as essential as food and ammunition in the prosecution of a successful campaign. Hence have arisen the most striking examples of the effectiveness of preventive vaccination, at first against small-pox and latterly against typhoid.

The effect of the present realignments of medicine of which I speak is particularly apparent in the case of the military surgeon, for the Parés, the Wisemans and the Larreys, the Pirogoffs, the Dupuytrens and the Langenbecks of to-day are occupied with preventive inoculation, with the screening of the sick, the protection of water sources; more concerned with the first-aid package than with the extraction of bullets; more often called upon to use the microscope than the scalpel and ligature. Little wonder that from men of this type great contributions have come. It is a far cry from Guthrie's amputation through the hip-joint at Waterloo to Laveran and the discovery of the malarial plasmodium, or to Walter Reed and the mosquito and yellow fever.

Changed duties of the military surgeon.

In the search for biological truths the God-given privilege of becoming

an obvious benefactor to his species comes to but few men. No one of the countless inquisitors of nature knows whether the mantle of recognition will fall upon him—or, for the matter of that, especially cares—provided he be given the personal satisfaction of having taken a step forward in knowledge, no matter how trifling at the moment that step may appear to be.

Experimentation and tuberculosis.

To whom is chiefly due the expectancy of recovery for the consumptive? Is it to Leuwenhoek and the miscroscope; to the father of Lister and to Abbé, who perfected its lenses; to René Laënnec and his stethoscope; to Sir William Perkin, whose experiments with the coal-tar by-products furnished the necessary colour reagents; to Villemin, who demonstrated its communicability; to Koch, whose genius made possible the recognition and cultivation of the organism; or to Ernst von Leyden's propaganda in Germany, and in the United States to Trudeau, himself a victim of the disease, through whose precepts and example tuberculosis has been moved into the open, where it is being effectively attacked in a campaign of education shared by layman, legislator, and physician alike? Unquestionably through experimentation on animals the most important step in this progress was made—the discovery of the bacillus tuberculosis and its identification as the causal agent not only in pulmonary consumption but in the many 'strumous' and 'scrofulous' disorders which puzzled our forbears.

Experimentation and syphilis.

Where will lie the chief credit for the approaching victory over the great social scourge which since its outbreak in Columbian times has undermined the vigour of the race? Will it be with those earlier men who gave us the tools of research, the microscope, the culture media, and the colouring dyes; with Wassermann and the possibility of a chemical diagnosis; with Schaudinn, who discovered the spirochæte; with Metchnikoff and the successful transfer of syphilis to the ape; or with Ehrlich, who, by his original methods, has had the triumph of synthetizing a drug possessing a special affinity for the infecting organism but which leaves uninjured the tissues of the infected host? There has been nothing heretofore comparable to this relentless, persistent, certain elaboration of a chemical compound which at a single dose may destroy, within the living tissues, the organism of a dread disease. Before it all past discoveries of therapeutic agents must make obeisance, even Jenner and vaccinia, Pasteur and the attenuated virus, Kitasato and Behring and the elaboration of the antitoxins.

What would the opponents of animal experimentation of 1876 have thought could this have been foreseen, this which is only the beginning, with pneumonia and cancer still to be overcome? That the means do not justify the end? That it is unfair to the lower animals, some species of which with unquestioned cruelty man sacrifices for adornment, for sport, for covering, for food; some of which he deliberately mutilates in

the process of domestication or in preparation for his table; some of which, like the infected rats and squirrels of plague-ridden districts, he must attempt to exterminate for his self-protection? But in the search for knowledge the investigator does not exempt himself as a subject of so-called vivisection when lower animals do not suffice for the purpose;[1] nor will he ever hesitate even to endanger his life, whatever may be the ethics of the question, if thereby information is likely to be gained concerning some disease fatal to his kind.

Experimentation and parasitic diseases.

To whom is due the approaching transformation of the tropics into a possible habitat for civilized man? Again a series of investigators on investigators' shoulders, until Theobald Smith, in the case of the tick-infected cattle decimated by bovine malaria (Texas fever), in 1893 showed for the first time that a parasite might be an essential intermediary host in the transfer of a disease from animal to animal. Promptly all blood-sucking parasites of man became objects of suspicion, and ere long convictions followed—first in the case of filaria by Manson; then Ross's demonstration that the mosquito is also an essential link in the cycle of 'million-murdering' malaria[2]—a discovery which was made possible through his studies of infected birds. But when it became necessary to establish unequivocal proof in the case of man, the younger Manson, and Warren, of the London School of Tropical Medicine, did not hesitate to submit themselves to the bite of infected mosquitoes sent for the purpose to England from the Roman Campagna.

Texas fever.

Malaria.

It is hardly possible for one unfamiliar with the experimental method and its necessary tedious controls to conceive of the patient, unflagging, time-consuming labours on the part of many investigators the world over, often conducted in most unhealthy districts and in the very shadow of death, which step by step, unwavering, led to this final demonstration —labours which in review seem almost beyond the possibility of accomplishment. The discovery of the malarial plasmodium in the blood, the determination of its several varieties, the study of the sexual cycle of its development, the changes in the stomach wall of the mosquito and the lodgment of the sporozoites in the glands of the proboscis, the parti-

[1] Henry Head's important studies on the sensory disturbances produced by a purposeful division of a nerve in his own arm may be given as an example.

[2] These significant lines, too little known, were written by Ronald Ross on the eve of the discovery:

This day relenting God
Hath placed within my hand
A wondrous thing; and God
Be praised. At His command,

Seeking His secret deeds,
With tears and toiling breath,
I find thy cunning seeds,
O million-murdering Death.

I know this little thing
A myriad men will save.
O Death, where is thy sting!
Thy victory, O Grave!

cular species among the many genera of mosquito concerned, the fact that the female alone is the active agent, the finding of the length of time necessary for infectivity—each step, whether by Frenchman, by Italian, by Canadian, by Englishman, or by German, a triumph of the spirit of research! And no great objection is raised if, in the process, the mosquito, bird, and man are the subjects of experimentation.

Yellow fever.

Soon the participation of another species of mosquito in the transmission of a still more dreaded disease was demonstrated in Cuba by the United States Yellow Fever Commission, at which time Carroll, Lazear, and some brave volunteers from the ranks permitted themselves to be bitten by infected parasites—the lamented Lazear dying a victim of the disease he had invited. The imagination of the public is only beginning to respond to these acts of heroism constantly being performed by investigators the world over—performed for humanity's sake, and surely no less but even more heroic than the quickly applauded dangers risked in warfare for the sake of country alone. Far better could our proof of the transfer of yellow fever through the bite of the stegomyia have come through the sacrifice of lower animals, had animals susceptible to the disease been available for the purpose, but to the members of that Commission there seemed no alternative to experimentation upon human volunteers. And what have been the results? Pestilential districts become habitable; commerce with tropical ports, once annually quarantined because of the recurrence of a dread scourge, continues the year round; across an isthmus formerly plague-ridden two oceans are being joined, where under a former régime shovels alone, without drainage and screens, proved utterly unavailing.

And after the cattle-tick and the mosquito, all other biting parasites—the flea and the bed-bug, the fly and the louse—have risen in dignity from a disgrace to a menace.[1] Immediately the patient studies of the insect world by the entomologist, disturbed from his quiet seclusion as a systematist into active participation in medical problems, become of the greatest practical value, and under the wing of preventive medicine his specialty, like that of the helminthologist and protozoologist, becomes as essential to the medical curriculum as was that of the botanist a century ago. These are astonishing changes to have been brought about by the experiments of one modern scientist who had the training, the

[1] Parasitism comes to have a far broader significance in relation to medicine than is covered by bacteriology alone, and from its widespread existence in nature, among plants as well as animals, and from the fact that 'every parasite has near relatives that do not possess the parasitic habit', it may be assumed that these habits are acquired, and that consequently some diseases may be of recent occurrence and that still others may arise anew. Metchnikoff has even suggested that among parasites we may look for the latest products of evolution. It is a far cry in the history of parasitism from the first given example—the misletoe, by Pliny—to a hæmatozoon, one cycle of whose development must take place in the body of a blood-sucking intermediary host.

imagination, and the patience to investigate the ticks of cattle afflicted with a destructive plague, and after four years of laborious study to identify them as essential agents of the disease.

Herein, it seems to me, lies the weakest point in the opposition to experimentation on the basis of cruelty—namely, that the animals whose preservation is desirable benefit from these investigations as greatly as man. There is no more notable example of this than the case of man's companion, the dog. Through the deserved attachment which has grown out of this companionship, a sentiment has arisen which would exempt the canine species from experimentation. But had such a law been put on the statutes, Copeman's discovery of the bacterial cause of distemper, and of a successful method of inoculation against this most fatal and distressing canine disease, would have been impossible; and the same is true of the fatal malignant jaundice—a parasitic blood disease conveyed by the bite of the dog-tick, so prevalent in some parts of the world as to make the rearing of dogs impossible, and for which Nuttall has found an effective remedy and means of prevention. What a credit to the societies for animal welfare could such discoveries have come through their own efforts rather than through the efforts of those whose methods of research they are prone to question!

Experimentation and the diseases of animals.

Societies for animal welfare.

Large sums of money have been wisely devoted to the prevention of cruelty to animals, and much good has been done in the past, but by a strange process of evolution most of those now entrusted with these funds, instead of grasping the opportunity to advance knowledge of the diseases of animals, have devoted their energies to opposing such advance as may be undertaken for the sake of man at some expense to animal life. The future offers a great o portunity for these societies, whose capital is now largely expended, on the one hand, in the wholesale sacrifice of stray and diseased animals, and on the other in destructive criticism of the methods of those they call vivisectionists; for by constructive investigation and by the employment of the same methods which have been elaborated by those whose primary object is the study of the diseases of man, they may become as great benefactors to animals, and incidentally to man, as the medical scientists have been to man, and incidentally to animals.

There could be no better outlet for the present wasteful methods of many of these organizations than the establishment of veterinary hospitals, in which modern methods of treating disease could be employed, further investigations made, and students of veterinary medicine taught—the three great functions of any hospital; and there is promise in some communities that this wise step may be taken.

Veterinary research hospitals.

Though less true of many European countries, where veterinary institutes which are doing admirable progressive work are under govern-

ment control, in close association with universities, in the United States, and I think the same is true in a measure of Great Britain, most veterinarians have profited not at all by the advance in general medical knowledge of the past generation. This applies particularly to veterinary surgeons who still trust, in the operations which they venture to undertake, to the rough and casual methods of old, with scant if any pretence of the modern refinements of skilful anæsthetization and aseptic surgical technique. Little wonder that people who are aware of this difference prefer to have their pets, when in need of surgical care, operated upon in an experimental laboratory rather than in many of the established veterinary hospitals. Some years ago, in the surgical laboratory at Johns Hopkins, this work grew to such proportions that a course covering the technique of operative procedures was offered to a group of veterinarians, who there for the first time learned methods which would enable them to save valuable animal lives by procedures which they had considered impossible, and which for the general run of veterinary surgeons had been impossible.[1]

When himself the victim of an operable malady, man voluntarily submits to a surgical operation, which is nothing other than vivisection, aware that the momentary risk and temporary discomforts—happily far less than they were of old, despite the increasing magnitude of the procedures which are undertaken—are but a small payment for the possible and probable ultimate good.

And most experimental procedures in the laboratory to-day are conducted on the same principles and with the same precautions that are observed in the hospital operating-room, and the rewards of experimentation, largely for these reasons, are greater than ever before. This is one of the great contributions which the surgery of Lister has made to the advancement of the medical sciences—a contribution as great as that represented by the immediate benefit to the stricken patient no longer liable to the dangers of wound infection.

Difficulties of experimentation.

It does not seem to be realized by the opponents of such forms of research as entail experimentation upon animals, how few individuals undertake it, for the work requires elaborate preparation, expensive and delicate apparatus, is time-consuming and fraught with baffling disappointments. Ehrlich experimented with 605 synthetically prepared chemical compounds before salvarsan was attained. Painful experiments were necessary before anæsthesia, just as painful surgery was necessary; and the extraordinary

[1] It was during this laboratory course that a woman prominent in the local antivivisection circle, who owned a number of cherished and interesting dogs, brought one of them, a valuable bull-terrier, to be operated upon for an extreme vaginal prolapse—one of the complications of whelping incidental to these highly-bred pets. The owner was so gratified by the result that the animal and one of its mates were subsequently brought to the laboratory to have their ears pointed and tails docked—a request which was of course refused. Such are the inconsistencies of mankind!

thing is that the physiologists of the days before surgical anæsthesia and reactionless wound-healing ever learned from animals what they did of the functions of the human body, for the solution of the problems of digestion, circulation, secretion, and nervous action cannot be satisfactorily undertaken if the subject be emotionally disturbed or suffer pain or be not gently and properly cared for. Whatever the conditions may have been in the past, the opponent of research need have no apprehension to-day on the score of the elicitation of pain. And in this connexion is it not extraordinary to recall the protestation once raised by poets, divines, and even physicians themselves, against the banishment of pain by ether and chloroform—for had not man been fashioned to suffer?

Anæsthesia and pain.

Experimental therapeutics will in time doubtless give us the ideal anæsthetic, in the form of a drug possibly allied to chloretone or scopolamine, a single injection of which will induce a prolonged insensitive sleep, perchance of long enough duration for primary wound-healing to occur. Then will the surgeon's weight of responsibility, whether in laboratory or clinic, be greatly lightened, for undoubtedly to-day inhalation anæsthesia itself gives him his chief sense of anxiety, and his patients, whether animal or man, their chief discomforts. Still, in spite of its present defects, anæsthesia—and it is a pity that there is no one man to whom we can unqualifiedly attribute its discovery—shares with Lister the credit of having made of surgery the most important agent which we possess for the cure of disease. Its principles are so definite, its technique so easily acquired, its performances in the long run so safe, that as a therapeutic measure human vivisection—to use this cruel word in a sacred sense—has almost wholly lost its terrors. The triumphs of surgery stand beside those of hygiene and preventive medicine as the notable medical achievements of these thirty years.

Of the new alignments which have been the outcome of modern surgery I particularly wish to speak. Is it not a striking fact that the health officers comprising the medical corps of our armies and navies—men who have a medical degree, and who may be called upon in an emergency to practise any branch of greater medicine—are called surgeons? I have indicated in some of the preceding paragraphs how far their activities may be removed from handicraft, supposed to be the chief business of surgeons. Though formerly this may have been their sole occupation, they are now coming to use more the armament of the scientific physician and public health officer.[1] Thus the army medical officer, unhampered by tradition, more nearly fulfils the office of the Greek physician, who, as Sir Clifford Allbutt has so well said, had no

The army surgeon becomes physician and health officer.

[1] One should of course not forget in this connexion Sir John Pringle, the originator of the Red Cross idea, who may be regarded as the founder of 'military medicine', and whose volume, *Observations on the Diseases of the Army*, London, 1752, is one of the medical classics.

more scruple in using his hands in the service of his brains than had Phidias or Archimedes; whereas his brother in civil life still adheres to the traditions of the times when the manual and debasing craft of surgery was cast off from medicine.

Surgery, by force of circumstances, groped its way alone through the dark centuries—a craft largely devoted to the repair of wounds and injuries inflicted in warfare. But its principles were sound, its growth steady—until now, and particularly in the past generation, it has rapidly developed into the most generally useful therapeutic measure which the physician has at his command. Its principles, moreover, are as profitably employed by the investigator in his laboratory as by the clinician in the case of an individual the victim of disease. It has served to break down medical sects and systems, such as Hahnemannism—for what principle of homœopathy justifies the use of scalpel and forceps? Indeed, surgery has been one of the great factors in the present realignments of medicine, for from Lister and Pasteur as their fountain head, the great streams of progress have flowed, in the case of the individual, into the art of surgery, and in the case of the community, into prophylactic medicine. Even the physician, who for so long held himself aloof from anything savouring of handicraft, returns to it with that useful instrument, the hollow needle; and paracentesis, lumbar puncture, and the extraction of blood for diagnostic, or the administration of drugs and sera for therapeutic purposes, by a minor surgical act are an acknowledged part of his therapeutic resources. By a strange transformation, too, he has become the phlebotomist, and the venesections and cuppings, formerly the overworked province of the barber surgeon, are largely practised by him to-day.

The physician reverts to handicraft.

Billroth said some thirty years ago, 'Die innere Medicin muss mehr chirurgisch werden,' and this seems to be what is taking place. Before Billroth's time it was largely internal medicine versus external surgery, for operative measures were necessarily confined to the exposed parts of the body; the visceral surgery of to-day—the larger part of the present surgeon's work, in the inauguration of which Billroth himself played no inconspicuous part—was then inconceivable.

We still retain many of the traditions of those earlier days, days when a pure craftsman, steeled to act in the face of unanæsthetized suffering, amputated, removed surface tumours, ligated vessels, and cut for stone, the fistula, and a few other ills, with an unerring hand and unbelievable speed. The high-road to surgery was through the anatomical dissecting room, and in these surroundings the operations of surgery were then, and are still, largely taught, with the result that the rule-of-thumb operations of one generation are handed on to the next, who will never use them, owing to the extraordinary progress ever making in these measures, due to methods of asepsis and the increasing knowledge of surgical possibilities.

Changes in the character of surgery.

To-day an individual of wholly different temper from the surgeon of

old ventures to do operative work, and the essentials for his training are of an entirely different order. Descriptive anatomy, useful as it may be to him, is no longer a prime requisite in the terms of the past generation, but his knowledge of visceral physiology and pathology must be broad, his observations of asepsis unimpeachable, his skill in hæmostasis and handling of the various tissues delicate and painstaking. As a training ground the anatomical dissecting room fast gives way to the experimental laboratory.

An entire change in the character of operative workmanship largely explains the transformation in the surgery of the past decade or two. The accurate and detailed methods in the use of which Kocher and Halsted were for so long the notable examp'es have spread into all clinics—at least into those clinics where you or I would wish to entrust ourselves for an operation. Observers no longer expect to be thrilled in an operating room ; the spectacular public performances of the past, no longer condoned, are replaced by the quiet, rather tedious procedures which few beyond the operator, his assistants, and the immediate bystanders can profitably see. The patient on the table, like the passenger in a car, runs greater risks if he have a loquacious driver, or one who takes close corners, exceeds the speed limit, or rides to applause.

And in all of this new visceral surgery it seems to me that the physician has merely come to do his own operating, that internal medicine is merely becoming surgicalized, much as military surgery has become largely medicalized. In the breaking up of greater medicine into its clinical specialties, the primary cleavage gave us the physician and surgeon, with medicinal versus manipulative forms of treatment as their essential distinction. Chiefly on anatomical lines each of these major subjects has broken up into a second or even a third order, but in the case of these further subdivisions it is to be noted that there is an inevitable tendency for operative therapy to become attached thereto, so that we have the ophthalmic or aural or laryngological surgeon, the gynæcological, orthopædic, genito-urinary or neurological surgeon, according to the direction whither opportunity or training or inclination may have led. Even the obstetrician—the half-brother of the physician and surgeon—reaches out for the operative side of the diseases of women, with the complete *Frauenklinik* in mind.

Visceral surgery and specialization.

And what is happening in these specialties is an indication of the tendency in the two major branches, for internal medicine and surgery, as the treatment of disease grows less empirical, unquestionably tend to converge. Having the same preliminary training, possessing the same diplomas, the graduates of our schools gravitate toward surgery if handicraft appeals, otherwise toward medicine, but in habit of thought and general attitude toward disease there is little difference to-day between the higher order of physician and surgeon. Though possessing a strong distaste for the act of operating itself, many physicians have admirable surgical judge-

Convergence of medicine and surgery.

ment and are perfectly capable of the surgeon's craft, just as a well-schooled surgeon should be capable of practising the physician's art. The basis of their training has been the same, and their divergence to-day comes about only through occupational likes or dislikes. Both have the same familiarity with the more common disorders—those of the abdominal cavity for example—and indeed the surgeon, provided he devotes the time he should to the preliminary study of his case, is apt to hold the advantage over his medical colleague in this regard, unless the latter industriously follows his patient to the operating table, where, as is known, he can often learn from living pathology much that was impossible from the pathology of the autopsy room.

A clinic, let us say on aneurism, is given in very much the same vein by both physician and surgeon, and their common road forks only at the post of treatment, where down one (and the longer) path beckon Valsalva, Tuffnell, and Balfour, to rest, a low diet and potassium iodide, and down the other (and shorter), Hunter, Corradi, and Matas, to some method requiring exposure of the lesion through an incision.

The surgical internist the physician of yesterday.

The internist has learned that effective operative work cannot be done well for him by one who merely represents his hands, and he would not venture to refer his patient with obstructive jaundice or hæmaturia or pyloric stenosis to a mere operator who did not have the same knowledge of and the same attitude toward the pathological lesion of liver or kidney or stomach that he himself has. This, in other words, is equivalent to the physician's doing his own surgery, for I think it is stupid to say, as has been said, that the surgeon has taken the appendix and gall-bladder, and now the stomach, thyroid and brain, and threatens to take the lungs and cardiovascular system and so on, away from the physician. It means merely that as the physician becomes more and more a craftsman and user of instruments of precision, internal medicine and surgery tend to draw together and to overlap, as they have not done since the thirteenth century, when the physician-priests were debarred by ordinance from undertaking any operation involving the shedding of blood.[1]

Neurological surgery.

In no subdivision of medicine has this been more apparent than in the difficult subject of neurology—a subject which has been conspicuously poor in therapeutic resources. Time was—and not long ago —when under the direction of the neurological diagnostician, who mapped out the field of operation on the scalp, blundering attempts were made to do his cranial surgery for him. The combination was an utter failure, for the same reason that similar combinations had always

[1] By no means should this idea be distorted into an encouragement for doctors with insufficient technical training to undertake their own operations ; and I understand there is a widespread tendency in some districts for them to do this, brought about in all likelihood by the fact that with his diminishing practice many a lesser physician feels that he can no longer afford to ' turn over ' his surgical work to another.

proved failures before. Not until the operative possibilities of neurology were taken up by those possessing some preliminary knowledge of and interest in the nervous system and its diseases, as was notably the case with Sir Victor Horsley—in other words, not until certain neurologists began to do their own surgery—did the recent rapid strides in this direction come about. To-day a school of operating neurologists is being trained to continue this work, for as promising a future lies before intracranial as lay before abdominal surgery; but the error must not be made of permitting surgical specialists to enter this or any other restrictive field of operative endeavour without a broad preliminary training in medicine and general surgery. This mistaken course, critics say, has been pursued in some of the established surgical specialties. That they may lose sight of the patient in their expert knowledge of the disorders of a certain portion of his body is a natural tendency of those who particularize in their work at too early a period.

This undesirable attitude can be forestalled only by a long apprenticeship in general medicine and surgery before specialization is undertaken, and by subsequent contact and free exchange of ideas with those who continue in more general work. Indeed, the existence of the operating specialist, as contrasted with the general surgeon, is justified only if the former takes advantage of his opportunities to contribute to the knowledge of the disorders he specially treats. When progress ceases to be made, through the intensive studies which the smaller field of work permits, there is every reason why the vagrant specialty should be called back under the wing of its parent, general surgery, from whom under no circumstances should it ever be permitted to wander too far.

The operating specialist and the general surgeon.

The surgical specialties, to change the figure, should represent merely grafts on the parent stem, for in their cultivation as separate plants they may cease to blossom and bear fruit. Indeed, the establishment of sub-departments as offshoots of general surgery in a given hospital is justified solely by the promise of productivity of the individual around whom such sub-departments are permitted to grow, but with no anticipation that a successive line of equally competent individuals will be found to justify the continuance of this or that specialty in perpetuity. By such a process of inbreeding the stock is rapidly weakened. It has been said that ' the specialist should be a trained physician, a skilled surgeon, and something more, but he is often something else—and something less '.

Place of the specialist.

One thing which has kept the so-called general surgeon from getting a distorted image of his patient's malady—a vice of which the specialist is often accused—is his wider experience with disease affecting the body as a whole ; and it would be rejuvenating to many of the surgical specialties if they could be periodically absorbed by general surgery, to be born again under the leadership of individuals who through fresh contributions could give a new impulse to a senescent subject. On this basis there are

any number of fields which under cultivation could be made to yield abundant crops ; for the blood-vessels, joints, thoracic viscera, ductless glands, and much else, are as deserving of intensive study from the operative standpoint as were the pelvic organs, the nose and throat, or the genito-urinary apparatus.

Rewards of special work.

And for those who on this basis prove worthy of the opportunities of specialization, and for whom every possible facility, in laboratory and clinic, should be given for intensive work, the most satisfactory rewards are open. In commenting on his thyroid investigations, the celebrated Pirogoff once said to Professor Kocher that ' the most perfect satisfaction which one can have in medicine comes through the thorough study of one special chapter in every direction and from every point of view—clinical, histological, physiological, and pathological '. No knowledge or experience which in fragmentary fashion may cover a multitude of ills can be comparable to this thorough familiarity with one subject from every possible aspect.

Institutional insularity.

Still the general surgeon is by no means exempt from the frailties of the hereditary specialist. He, no less than others, easily becomes the slave of local custom, a creature of habit, who accepts innovation with reluctance. The customs, good and bad, of a surgical department are easily handed on from chief to house officer, to clinical dresser, with little change from generation to generation. Customs which once were good may have staled, and those whose vision is limited to the walls of a single institution be unaware of it. At the beginning of the present century, twenty years after it was deemed unnecessary by its originator, the carbolic spray was actually to be seen in use in a famous hospital.

A certain loyalty to the methods of a locality, and even to those of an individual hospital, is apt to be cherished and suspicion cast upon the hearsay methods and results of other, and possibly rival, clinics. This, I am told, was formerly true of your great London hospitals no less than of others. New technical principles, unless they have been observed and their value appreciated, find their way slowly from institution to institution. Reading of methods will not suffice ; the objective exchange of ideas, which can come through demonstration alone, is necessary. The rubber glove was in general use in Halsted's clinic for twenty years before it was adopted elsewhere. Those who had not visited his operating room scoffed at the idea. What was to become of our prized *tactus eruditus*? But onlookers gradually became disciples, and now this useful safeguard is so generally employed that the very source of the idea is forgotten.

Aids to precision.

' Surgical instinct ' and the ' educated touch ' have been overworked shibboleths which have stood in the way of many innovations, particularly those which concerned the introduction into practice of instruments of precision. As told in rhyme by Oliver Wendell Holmes, fun was poked at Laënnec and his newfangled toy, the stethoscope. Probably Floyer heard a protest against the ' pulse watch ',

and Wunderlich against the thermometer; and only yesterday was one raised against the instrumental measurement of blood-pressure. Had not the hand been industriously trained to estimate the degree of fever by contact with the patient's brow, and the fingers the quality of the pulse at his wrist? Even the Röntgen ray brought misgivings to those skilled in the elicitation of crepitus from fractured bones.

The tendency to disparage the so-called accurate or scientific attitude in medicine and to make much of the practical doctor or surgeon who is superior to the microscope and other laboratory accessories is rapidly passing. It was one of Paré's canons that

> Science sans expérience
> N'apporte pas grand' assurance.

But the confidence which is bred of practice uncrossed with science is still less dependable. Abraham Flexner states that during his study of the North American medical schools he heard much talk of training the practical rather than the scientific doctor, and remarks that the chief difference between them, as far as he can see, is that the scientific doctor is less likely to lose his patient. Most progressive surgeons of late years have adopted the wise custom of frequent inter-institutional visitations, and this custom of attending the clinics and observing the methods and workmanship of others has done much to reconcile these opposed points of view.

Travel organizations.

To make this habit more effective than was possible when indulged in by an individual alone, just ten years ago a small group of surgeons in the United States formed a 'Travel Club', which at stated intervals has since visited, in rotation, the institutions of the six or eight important medical centres represented in their organization. At these exercises no papers are read, but a concerted effort is made by the local members of the society and their colleagues to open their clinics, laboratories, and class-rooms for inspection while under full operation. Thus, as in our student exercises the present educational tendency is less and less toward subjective, and more and more toward objective methods of teaching, so the success of the organization I mention has demonstrated that the same principle is equally applicable to medical societies. Similar travelling groups have come to be established in other divisions of medicine and in more specialized branches of surgery, and I believe, too, that the idea has taken root in England and other countries.

The Society of Clinical Surgery.

From its foundation, the object of our society, inasmuch as its members were mostly teachers and investigators as well as surgeons, was threefold—to observe the methods of instruction pursued by their colleagues in other cities, to follow at first hand the progress of their laboratory studies, and to attend their surgical procedures in the operation room. Our early peregrinations disclosed very obvious differences in surgical habits, thought, and workmanship among the various institutions represented in the society membership—

differences, however, which in the course of a few years largely disappeared. Unquestionably there is now a more nearly equal and a much higher level of workmanship throughout ; and as the members of the organization in one capacity or another are in the position to pass along the instruction which they have received, this will not only have a broadening effect on the surgery of the present, but a still more marked influence on the surgery of the next generation. Such a clinic as that of the Mayo brothers, where may be seen a composite of the best in international surgery, is a good example of the effect of sympathetic, intelligent, and systematic inspection of the work of others.

Experimental pathology and surgical technique.

As I have said, the application of surgical principles, whether in laboratory or clinic, is constantly becoming more general. The slipper of surgery has been found to fit that Cinderella of Medicine, experimental pathology, whose coach now has devoted outriders representing all departments. Observations which even in the hands of a Bernard or a Cohnheim were impossible before the era of reactionless wound-healing now become possible, and not only may the counterfeit of conditions of disease be produced and studied without the complicating element of sepsis, but, with surgical methods, the Pawlows and Carrells of the laboratory bring about altered conditions which shed new and important light on physiological processes.

All this has led to the establishment of special laboratories of surgical research, where modern operative methods are particularly applied, but as a matter of fact they are nothing more than laboratories of experimental pathology, or, better still, of *experimental medicine*—as the Institute in St. Petersburg and the Hunterian Laboratory in Baltimore are called. The establishment of similar institutions elsewhere indicates that an increasing number of surgeons to-day have instincts which lead them into the broader aspects of disease and away from the mere operative tasks that formerly kept them in the dissecting room. Other than this there is no special significance in these laboratories, where investigations are undertaken which are as appropriate for anatomy, physiology, biochemistry, or pathology as for medicine or for surgery.

Departmental interdependence.

Indeed, the definite boundaries formerly separating these subdivisions of the curriculum have become so overgrown by surgicalized experimental pathology that it is sometimes difficult to tell when the investigations of one department are trespassing on the preserves of another, nor does it much matter if the common goal is the advancement of medical knowledge. This unquestionably is a development in the right direction, for it is a peculiarity of the medical sciences, as Huxley once remarked, that they are independent in proportion as they are imperfect. Even anatomy, long a purely descriptive science, is adopting the experimental method. At Johns Hopkins a professorship of *physiological* anatomy has recently been established, and the Carnegie Institution has founded an institute of experimental

embryology and has put a great anatomist at its head. These are straws of promise for the future anatomist, and he will be brought into closer contact than before with the physiologist, the pharmacologist, and the pathologist, who themselves already touch elbows so intimately that many of the problems which engage one of them might suitably be undertaken in the laboratory of one or the other of his colleagues.

In consequence of this lessened departmental insularity, all react far more quickly than heretofore to a ray of light disclosing some new aspect of disease, just as they do to some novel method of study which reopens a door long closed against profitable investigation. The glands of internal secretion and their interrelations, brought to the fore primarily through the clinic; the principle of intravital staining, with all its promising ramifications, introduced by the experimental therapeutist; the studies of cellular physiology which refined methods of tissue-staining promise to make so fruitful; and the growth of tissues *in vitro* by the experimental anatomist—these occur as immediate illustrations.

A closer contact between clinical and preclinical science.

Indeed, the possible prompt application by the clinician of many of the discoveries made by his colleagues in the medical sciences, as well as the fruitfulness in turn of the hospital clinic in problems suitable for the pure scientist, have served to realign them so that in some institutions the physiologist and pharmacologist have wisely been given posts comparable to that long held by the pathologist alone. Thus, through experimental or physiological pathology—or by whatever term one may wish to designate the present rejuvenation of a method which is having such a strong influence in the unification of their labours—biologist, morbid anatomist, therapeutist, hygienist and sanitarian, physician and surgeon alike, are brought into closer copartnership than has heretofore been thought necessary or advisable. And as the physician and surgeon develop under the influence of a closer contact with their brethren of the non-clinical medical sciences, the leaders of these two branches will of necessity come more and more to hold an academic attitude toward their posts.

Hospital practice versus home practice.

This inevitable tendency, so far as our hospitals and schools are concerned, will have a revolutionizing effect on clinical medicine and surgery. The change cannot be made in a moment, any more than it was possible in a moment to place anatomy and physiology and the other preclinical sciences on a full-time academic basis, but once established we would no more recede to the earlier conditions, where energies were divided between school and practice, often to the detriment of the school, than we would now in the case of the so-called scientific branches.

And this brings me to the final subject on which I wish to touch, one which of late has aroused much discussion and has been thoroughly ventilated here in London before the Commission on University Education —namely, the relation toward the hospital and medical school to be held

by the new order of physician and surgeon and their junior associates. Herein lies a matter of great concern to many and a problem which will not be solved by shunning it.

Our great public hospitals have ceased to be grievous and infected places, and people are rapidly losing their dread of them. Meanwhile, as disease becomes better understood, the complexities of its accurate recognition and successful treatment become ever greater and require the studies of an increasing number of co-workers—a situation which makes a most unsatisfactory matter of the office or home consultation. In consequence people, in greater and greater number, desire when ill to enter institutions for study, and this applies to the well-to-do as well as to the poor.

Increasing complexities of diagnosis and treatment.

Consider, for example, the present-day methods essential for the recognition and treatment of a single disease which with its varied complications is possibly not only the most prevalent one the doctor encounters, but which has been regarded as the one most easily prescribed for. Indeed, so definite and so effective were his therapeutic measures supposed to be that the shabby habit was acquired of making the administration of iodides and mercury serve as an aid to diagnosis—a habit which often led to added confusion. To-day the clinical acumen of the practitioner, experienced though he may be, has given way to a chemical test by a laboratory expert, and only when the disease is thus proved to exist is a diagnosis accepted. The discovery of the spirochæte and the study of its biological habits have taught us that in certain parts of the body, especially the central nervous system, the organism is not accessible to the former methods of treatment, or indeed, if reached, that it may have acquired an immunity and resistance toward the very drugs supposed to destroy it.

Let us suppose that the malady has taken the form of a cerebral gumma. The patient has headaches, and there is a suspicious clinical history. What is required ? A lumbar puncture, a cytological study of the fluid, and the Wassermann test requiring one specialist ; an ophthalmological and perimetric examination needing another ; a neurologist certainly, for a careful study is necessary to determine if possible the situation of the lesion ; probably, too, a röntgenologist ; and in the end, perhaps, another to administer salvarsan ; or, in the case of a non-absorbable fibrosyphiloma, as likely as not an operation will finally be needed. And this for what was yesterday a simple problem, easily faced by the practitioner single-handed ! Thus, scientifically accurate diagnostic measures and a new form of therapy requiring blood-letting and manipulative skill make a craftsman even of the syphilographer. This is a far cry from a written prescription, a bottle and spoon.

Requiring a multiplicity of consultants.

No, the practitioner cannot be chemist, neurologist, bacteriologist, ophthalmologist, radiographer, surgeon, and what not rolled into one,

and do effective work. The Jonathan Hutchinsons of the profession are, alas! rare. And as the co-operation of those expert in special lines becomes more and more necessary the tendency will grow for these conjoint studies of individual cases of disease to be carried out in properly equipped hospitals, where the data essential for a diagnosis can be more quickly and effectively accumulated and the paraphernalia for treatment kept in smooth running order from constant use. This is particularly true in so far as it concerns surgery, for in proportion as this form of therapy is the more dangerous, so much the more need is there for surrounding it by every possible safeguard against misuse or accident.

The more difficult and complicated problems of disease will thus gravitate to large institutions where no longer 'visiting' appointees but directors of hospital units in continuous service, aided by a correspondingly adapted hospital administration, can uninterruptedly devote themselves to their work without entering into competition for practice beyond the walls of the institution. For when advantage is taken of a hospital position to make it a high-road to practice, the visiting physician or surgeon immediately becomes a less valuable institutional servant, if for no other reason than through the dissipation of his energies. When this abuse is widely corrected the family physician of old, so rapidly passing as a type of practitioner, and than whom no more useful member of the community ever existed, may again come into his own, with an even larger and better field than before, and quick to take advantage, in his more difficult and serious problems, of institutions where the chiefs of service are in no sense his competitors, but rather his coadjutors. Owing to the present dismemberment of medical practice into its many specialties the public has begun to feel that there is no balm and no physician in Gilead.

Academic clinical posts.

The family doctor.

Meanwhile it will be the *energetische Imperativ*, to use Ostwald's symbol, of the salaried hospital incumbents to take advantage of their opportunities to observe and investigate conditions of disease for other and higher reasons than the expectation of financial returns from competitive practice. They will also instruct and be instructed by their full-time junior associates, and these in turn by the student body, without whose actual aid and stimulus a properly modelled hospital organization can hardly survive, and who in return will receive, in addition to the advantages once attached to the old apprenticeship system, the added benefit of contact with the active work of co-operating departments.

Hospital patient, student, and teacher.

The cry has been raised that this evolution of the physician and surgeon will make teachers incompetent to instruct those who are to enter practice, but this same cry was once raised against the appointment of a full-time physiologist, anatomist, and pathologist, whose loss of contact with practical medicine, it was presupposed, would disqualify them on these same grounds. After all, is not the essential thing to inculcate in the

student's mind the habit of acquiring clinical knowledge for himself? And there is no possible way of doing this except by bringing him into immediate touch with the sick-bed. This, in the terms of Huxley, makes for centrifugal education, whereas our customary methods are centripetal in direction, with the effort to drive formulas into the student's head rather than to teach him how to produce ideas of his own. In an address on this subject Henry Fairfield Osborn aptly said that 'the measure of a teacher's success lies in the degree with which ideas come, not from him, but from his pupils'.

Summary.

These, then, are some of the transformations and realignments which are taking place in medicine, and which, directly or indirectly, have come through the great contributions made a generation ago by those with whose names this address was introduced: the public, not only awake to the great developments in medicine which animal experimentation has made possible, but ready to participate in their application for the general welfare; the physician at large, the valued family adviser, reaching out toward the important problems of hygiene and prevention of disease, while the individual patient, as the complexities of disease unravel, needing more and more specialized and more and more surgicalized treatment, gravitates toward the modern hospital; the preclinical science departments, which formerly existed in splendid isolation, with their fences down, owing to the levelling influence of experimental pathology; hospital organizations undergoing changes which will ultimately require the full time and continuous activity of those who serve them for the benefit alike of student, of science, and of patient.

The kaleidoscope of medicine is turning. These are merely some of the present rearrangements of the images as I see them—new patterns from original fragments—for 'Is there anything whereof it may be said: See, this is new? It hath been already of old time, which was before us'.

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